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Pacific Northwest National Laboratory
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Advanced Fingerprint Analysis Project Fingerprint Constituents

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T.R.W. Clauss

September 1999

Prepared for the Assistant Secretary of Defense, Office of Special Technology, Technical Support Working Group under a Related Services Agreement With the U.S. Department of Energy Under Contract DE-AC06-76RLO 1830

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DISCLAIMER

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SUMMARY

The work described in this report was focused on generating fundamental data on fingerprint components which will be used to develop advanced forensic techniques to enhance fluorescent detection, and visualization of latent fingerprints. Chemical components of sweat gland secretions are well documented in the medical literature and many chemical techniques are available to develop latent prints, but there have been no systematic forensic studies of fingerprint sweat components or of the chemical and physical changes these substances undergo over time.

In this study, seventy-nine samples were collected from very young children, adolescent, and adult subjects in an effort to gather information which would be representative of the general population. A protocol for this collection was developed which allowed for fingerprint transfers, aging, and analysis. Only volatile components of fingerprint residue or those which could be converted to methyl esters through derivatization with diazomethane were studied. The resulting data indicated that the principle volatile components under 500 daltons are comprised of fatty acids, steroid precursors, and wax esters. Aged samples show that squalene, oleic, and palmitoleic acid undergo significant degradation after a 60 day exposure to air, with the total amount of material extracted decreasing over time, possibly degrading to smaller molecules. Thus, with aging, various degradation processes serve to shorten and oxidize components in fingerprint residue possessing unsaturated moieties in their structure. As a result, chemical functional groups which could possibly be used for fluorescent tagging, are eliminated. A significant observation was that the inherent inhomogeneity in fingerprint samples made quantitative comparisons (with respect to time) of individual components difficult. Considerable variation exists between samples obtained for these aging studies. While most adult prints yield components indicative of sebaceous secretions, the very young afford mostly aqueous saline for the print image. Irregular yet interesting results are observed in children around the age of maturation. A few samples from this age group showed cholesterol as the

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